



Vertebral Fracture and Its Outcomes in Emergency Patients of Kowsar Hospital in Sanandaj: An Epidemiological Study

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Abstract

Background: Vertebral fracture, one of the most incidents in human life, is associated with many complications. Due to the importance of this complication, this study was conducted to epidemiologically investigate vertebral fractures and their consequences in the emergency department of Kowsar Hospital in Sanandaj in 2017.

Methods: In this retrospective cross-sectional study, 350 patients who visited the emergency department of Kowsar Sanandaj Hospital in 2017 due to vertebral fractures were included. The data was extracted from information collected through phone contact and patients' medical documents. V Kramer and ETA tests were performed to analyze the hypotheses using SPSS 25 software.

Results: Men constituted 61% of the patients. The average age of the patients was 42.18 (6.86) years, and almost 41% of the patients lived in Sanandaj. The most common trauma mechanism was fall injury with 44.8%, 59.55% of which were in the lumbar region. Compression and burst fractures had the highest fracture rates with 47.85 and 21.9 percent, respectively.

Conclusion: According to the findings, the fractures were more prevalent in men, young people, and in labor and agricultural occupations, and there is a significant relationship between the consequences of fractures with age, sex, and occupation, which indicates the need for more safety considerations in these people. Therefore, it is necessary to identify and subsequently modulate the risk factors associated with falling injuries to reduce this type of injury.

Keywords: Fracture, Injury, Spine

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Received: Sept 30 2023

Accepted: Dec 27 2022

Citation to this article:

Hayati I, Saedi A, Azizkhani L.

Vertebral Fracture and Its Outcomes in Emergency Patients of Kowsar Hospital in Sanandaj: An Epidemiological Study. *J Iran Med Council.* 2024;7(2):309-15.

Introduction

Spine is one of the most complex parts of human body's skeletal structure, which contributes to maintaining the body's balance. Since it encloses and protects the spinal cord, it is an essential human body part (1). The vertebrae support about three-fourths of the body's weight, and the main structure of the body comes as a result of the anatomy of the vertebrae. However, this vital structure is sensitive and can be injured due to different causes (2-5).

Spinal injuries, sometimes associated with different levels of spinal cord injuries, considering the current human lifestyle conditions, are common incidents that can result from various causes (6). The level of a spinal cord injury refers to the specific location on the spinal cord where the injury occurs. The level of injury determines which parts of the body are affected and the extent of paralysis or loss of function (7).

Cultural factors play a significant role in shaping the course of human lives. The concept of "life history" explains the different stages of life from an evolutionary perspective. These stages include infancy, childhood, juvenility, adolescence, adulthood, and old age (8). Studies have reported the incidence of spine injuries as being high, ranging from 19 to 88 people per 100000 people in various studies (9). The prevalence of spinal cord injury also varied from 480 to 818 people per million people (9). Accidents with motor vehicle fall and street fights have been reported to be the top three most prevalent injury mechanisms, respectively (10).

Tree falls, in which occupational and seasonal factors play a role, have been reported to be one of the common causes of spinal fractures in Iran (11). This incident annually imposes a high cost on the country's medical system, and considering the young age of most patients, it proves to be quite costly in the long term (12). This disorder's long-term consequences depend on the initial injury, natural tissue recovery and restoration, medical interventions, rehabilitation measures, and community adaptation (13). Tissue repair is defined as the restoration of tissue architecture and function following an injury (14). Spinal injuries can damage the spinal cord, resulting in various motor, sensory, and sphincter disabilities and even instability and death (9).

Although spinal fractures comprise a small percentage

of all traumatic injuries, their social and economic impact on the patient is surprisingly more than other injuries (15). Various high-cost interventions are required to restore the vertebra's original function after the fracture (12). These interventions may ultimately not result in the desired outcome, and the patient will not be able to function the same as before (12,16,17). Considering the burden of this disorder on the individual and society, it seems necessary to progress toward more effective treatments with a focus on improving neurological outcomes and post-trauma complications (18). Careful study of the injuries and timely medical decisions will tremendously impact reducing the economic and social burdens of these injuries (2). Since there is no definitive treatment for spinal cord injuries, prevention-based strategies seem to be a priority. The first step to preventing these injuries is to study the contributing epidemiological factors.

There are no accurate data on vertebral fracture statistics in Iran, but due to their high prevalence, acute spinal injuries are expected to constitute a high number. Considering the burden of spinal injuries, to develop effective preventive, educational, and management programs, population-specific studies of the components of spinal injuries, prove to be essential. Therefore, the present study aimed to investigate the epidemiology of spinal fractures and their components in emergency patients of the trauma center Kowsar Hospital in Sanandaj in 2017.

Materials and Methods

In this cross-sectional study, the data were collected after being approved by the Ethics Committee of Kurdistan University of Medical Sciences IR.MUK.REC.1398.163 and obtaining the necessary ethical permits. The sampling method in this study was total population sampling. The statistical population of the current study consisted of all the patients referred to the emergency department of Kowsar Hospital of Sanandaj in 2017 from May to November due to spinal trauma. All the patients whose spine fracture was confirmed in plain radiography or CT scan by the neurosurgeon and Emergency medicine specialist were included in the study. Exclusion criteria were the non-conformity of the imaging report with the doctor's diagnosis, MRI or lack of imaging report

in the file, leaving the hospital by the patient before the diagnosis, not knowing the anatomical location of the injury mechanism and type of fracture, and incomplete demographic information. Finally, all the patients who fulfilled the inclusion and exclusion criteria were entered into the study.

A checklist containing the demographic information of the patients and the cause of the injury (including head-on accidents, car rollover, motorcycle accidents, pedestrian accidents, slip and fall accidents) was used. Also, cases such as sports injuries, street fights, gunshot injuries, *etc.*, due to their low prevalence, were all considered as other causes. The type of injury classified based on the Denis classification of spinal fractures (in which the spinal fracture is divided into two major and minor parts), the major categories including fracture-dislocation, bending (the type caused by the seat belt), burst and compression and also the minor categories involving transverse processes, pars interarticular, articular and spinous processes were included. The site of injury (including cervical, thoracic, lumbar, thoracolumbar and sacral vertebrae) and the fracture outcomes [including the need for surgery, paresis, spinal canal involvement, paresthesia, sphincter disorders), the need for ICU (Intensive Care Unit), plegia, infection, back pain, social complications, divorce, death, *etc.*] were recorded.

After examining the patients' documents, the required information was registered, and additional information, including the fracture outcomes, was collected through telephone contact. The Chi-square test and correlation test of Kramer's V were used to determine the relationship between qualitative variables, and the ETA correlation test was utilized for quantitative variables. In the case of the non-normal distribution of the data, corresponding non-parametric tests were used. In this study, the data was analyzed using SPSS version 25 software, and the significance level in this test was considered to be 0.05.

Results

In this study, 350 patient documents were examined; 60.9% were men, and 39.1% were women. The average age of the patients (18.86) was 42.6 years (max=86, min=4). The highest frequency was related to the age group of 21 to 40 years (33.7%), and the

lowest was in the age group below 20 years (13.4%). 41.1% of the patients were residents of Sanandaj (the capital city of Kurdistan Province). Regarding the patients' occupations, most of them were housewives (32.6%), and the lowest frequency was related to government employees (5.7%) (Table 1).

The most frequent cause of the accident was fall injury (44.8%), and the least frequent was motorcycle accidents (4%). In general, 420 cases of spinal fractures were observed (some patients had two or more fractures), with the highest frequency (47.85%) of compression fractures and the lowest frequency of bending fractures (seat belt type) (<1%). 60% of the fractures were associated with the lumbar region (Table 2).

Table 1. Demographic information

| | Variable | Frequency | Percentage |
|--------------------|---------------------|-----------|------------|
| Gender | Male | 213 | 60.9 |
| | Female | 137 | 39.1 |
| Age (yr) | ≤20 | 47 | 13.4 |
| | 21-40 | 118 | 33.7 |
| | 41-60 | 115 | 23.9 |
| | ≥61 | 70 | 20 |
| Place of residence | Sanandaj | 144 | 41.1 |
| | Saqez | 18 | 5.1 |
| | Marivan | 45 | 21.9 |
| | Baneh | 26 | 7.4 |
| | Bijar | 5 | 1.4 |
| | Kamyaran | 29 | 8.3 |
| | Qorveh | 37 | 10.6 |
| | Divandareh | 23 | 6.6 |
| | Dehgolan | 10 | 2.9 |
| Other | 13 | 3.7 | |
| Occupation | Worker | 60 | 17.1 |
| | Farmer | 35 | 10 |
| | Government employee | 20 | 5.7 |
| | Housewife | 114 | 32.6 |
| | Driver | 21 | 6 |

Table 2. Fracture variables

| | Variable | Frequency | Percentage |
|-------------------|-----------------------|-----------|------------|
| Cause of Accident | Head-on accident | 31 | 8.9 |
| | Car rollover accident | 72 | 20.6 |
| | Pedestrian accident | 28 | 8 |
| | Motorcycle accident | 14 | 4 |
| | Slip accident | 32 | 9.1 |
| | Fall accident | 157 | 44.8 |
| | Other accidents | 16 | 4.6 |
| Type of fracture | Fracture-dislocation | 201 | 47.85 |
| | Bending (seat belt) | 92 | 21.9 |
| | Burst | 2 | 0.47 |
| | Compression | 12 | 2.85 |
| | Transverse processes | 78 | 18.57 |
| | Pars Interarticular | 12 | 2.85 |
| | Articular processes | 4 | 0.95 |
| | Spinous processes | 19 | 4.52 |
| Site of fracture | Cervical | 25 | 6.36 |
| | Thoracic | 93 | 23.66 |
| | Lumbar | 234 | 59.55 |
| | Thoraco-lumbar | 29 | 7.38 |
| | Sacral vertebrae | 12 | 3.05 |

Discussion

Traumatic spine injury is one of the common causes of disability and death (4). Since it decreases patient efficiency and requires treatment and rehabilitation, it is associated with heavy economic losses (4). In this study, most of the patients were young people aged 21 to 40 years (33.7%), and the prevalence of fractures in men was higher than in women (61% versus 39%). In Safaei and Fakharian's study, the prevalence of fractures was higher in young men (11, 14). Compared to other age groups, young people have more physical activities and are more exposed to trauma due to employment or other reasons. Also, men are more exposed to severe traumas due to occupational issues. Therefore, with these two points, the higher prevalence of fracture in these people can be justified. 32.6% of the patients were housewives,

and 17.1% of them were workers, thus the results show that most of the women who suffered from spinal trauma did not work outside the home. This point indicates that women are more vulnerable in the spine area, which requires educational and preventive measures. The second rank is related to the workers, which is a probable finding considering their working conditions and their risks. By examining the relationship between the consequences of spinal fracture and the gender of the patients, it was found that there is a significant relationship between gender and spinal canal involvement and the development of paresis; therefore, the frequency of both of these complications was higher in men. The age variable was significantly related to all the outcomes, including the need for surgery, pain, spinal canal involvement, and neural lesions. Hence, the frequency

of all the outcomes increased with age. Occupation of the patients was also significantly associated with fracture outcomes.

Investigation of the fracture outcomes and the cause, type, and site of the fracture showed a significant relationship between the cause of the fracture and complications, except for plegia and sphincter disorders ($p < 0.05$). Also, regarding the type and site of the fracture, there is a statistically significant relationship between these two variables with all the fracture outcomes. In the present study, 44.8% of the spine fractures were due to fall injuries. The geographical situation of Kurdistan province can explain the high frequency of falls in this group of patients since Kurdistan is a mountainous region. Also, due to this region's many gardens and trees, accidents are more likely due to gardening or recreational activities. Falling from buildings can also explain the high prevalence of spine fractures in construction workers. Eighty-three (90.2%) patients fall from the same level, four (4.3%) from stairs, and five (5.4%) from more than one-meter high. Five (5.4%) patients presented to the hospital after 24 hours of injury. 82 patients (89.1%) had bone fractures. The lower extremity was the most common injured body region followed by the upper extremity and chest (19). Also, in Safaei *et al's* study, in Gilan province, falling injuries have been the most frequent cause of spine fractures, which is consistent with the results of this study (20). In Kumar's study conducted globally, traffic accidents had the highest frequency among spine fracture causes (10). In this study, traffic accidents ranked second and accounted for 41.5% of the fracture cases.

In contrast, in Safaei's study (19), this frequency was 35%, which can be attributed to the poor road conditions in Kurdistan province. 59.55% of the fractures occurred in the area of lumbar vertebrae. In Safaei's study, the prevalence of fractures in the lumbar vertebrae was higher (19). Fakharian's study reported that fractures following a falling accident occurred mainly in the lumbar region, but fractures caused by traffic accidents occurred mainly in the neck region (17). In Kumar's study, where traffic accidents ranked first, the most frequent fractures were in the neck region (10). Therefore, it can be argued that the neck area is most likely to be affected in traffic

accidents. Compression fractures (47.85%) and burst fractures (21.9%) were the most common types of fractures in this study, which can be associated with the mechanism of trauma (traffic accidents and falls from a height). However, minor fractures included only a small percentage of the fractures, which could be the result of fewer hospital visits in less severe cases and outpatient management in treatment clinics, or probably no detectable fractures with the available imaging equipment; however, in Safaei's study, burst fracture of the vertebra accounted for more than half of the cases (20).

This study's results represent no significant relationship between gender and fracture outcomes, except in two cases, which can be attributed to the difference in the spine anatomy and the cause of fracture (trauma mechanism) between men and women. However, unlike gender, there is a significant relationship between age and fracture outcomes, which can be attributed to the similar trauma mechanisms in each age group.

Except for plegia and sphincter disorder, the cause of fracture was significantly related to other fracture outcomes. Also, there is a significant relationship between all the fracture outcomes and the fracture's type and site. This relationship can be seen as a result of the fact that different mechanisms of trauma can usually result in certain types of fractures, and a specific type of fracture in a specific site of the vertebra, the resulting damage is similar. Moreover, it will have a predictable and inevitable consequence regarding the relationship between the cause of the fracture and its outcome. In two cases where the result was insignificant, this lack of relationship can be attributed to the small sample size. This issue needs to be investigated in more significant populations.

One of the limitations of the project is the short-term implementation of the project, which is better to be done over three years instead of one year, and it is also better to do it on a larger statistical population.

One of the features of the present study is to show the statistics of spine fractures and the type of accident that caused these fractures in mountainous areas such as Kurdistan.

Conclusion

The results of the current study indicated a higher

prevalence of spinal fractures in men, young people, housewives, and workers. And most of these fractures were due to falls and traffic accidents. There was a significant relationship between fracture outcomes and age, gender, occupation, cause, type, and fracture site. These findings call for more care and training programs focusing on preventive measures. Training and protection programs are essential, especially in the field of occupational health and also vehicle safety. It is suggested that more extensive studies be carried out in this field to minimize the enormous financial and human costs. Also, considering the characteristics and vertebral fracture outcomes in the studied population, providing enough arrangements for correct and timely management in hospitals in this

region seems necessary.

Acknowledgements

The present study has been financially supported by the Deputy of Research and Technology of Kurdistan University of Medical Sciences under the ethics code IR.MUK.REC.1398.163. We, with this, express our appreciation and gratitude to the archival personnel of Kowsar Hospital of Sanandaj for their excellent assistance and to the Student Research Committee of Kurdistan University of Medical Sciences.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

1. Kim M, Kim HS, Oh SW, Adsul NM, Singh R, Kashlan ON, et al. Evolution of spinal endoscopic surgery. *Neurospine* 2019;16(1):6-14.
2. Oliver M, Inaba K, Tang A, Branco BC, Barmparas G, Schnüriger B, et al. The changing epidemiology of spinal trauma: a 13-year review from a level I trauma centre. *Injury* 2012;43(8):1296-300.
3. Sardarian K. [Microanatomy of cancellous bone in women and men of similar bone mass with and without vertebral fracture.] *J Guilan University Med Sci* 2002; 11 (42) :63-73. Persian
4. Rehani-Kermani H, Ramezani MA. [Assessment of corelation between spinal canal shape and spinal cord injury in thoracolumbar spine fractures.] *J Kerman University Med Sci* 2003 Dec 1;9(1):40-5. Persian https://jkmu.kmu.ac.ir/article_33127.html
5. Rezaeian M. [A review on the book "Clinical Epidemiology".] *J Rafsanjan University Med Sci* 2016;14(11):997-8. Persian
6. Rockville Pike B, MD. *Spinal Cord Injury*. 2023.
7. Levels of injury 2020 [Available from: <https://www.spinalinjury101.org/details/levels-of-injury>].
8. Lev Go. Modern life is accelerating human evolution – and that can prove destructive. 2021.
9. Zeinali M, Jahanbakhshi A, Shahivandi A, Dastmalchi A. Epidemiology of traumatic spinal fracture: a study of trauma hospital in southern Tehran. 2018.
10. Kumar R, Lim J, Mekary RA, Rattani A, Dewan MC, Sharif SY, et al. Traumatic spinal injury: global epidemiology and worldwide volume. *World Neurosurg* 2018;113:e345-e63.
11. Zargar M, Khaji A, Karbakhsh M. Injuries caused by falls from trees in Tehran, Islamic Republic of Iran. *East Mediterr Health J* 2005;11(1-2):235-9.
12. Azizi TH, Hejazi SS, Kameli A. Frequency of complications of falling from the walnut tree, as an occupational-seasonal injury. *J Inj Violence Res* 2018;10(2):91.
13. Potvin JR. Occupational spine biomechanics: a journey to the spinal frontier. *J Electromyogr Kinesiol* 2008;18(6):891-9.

14. Tissue Repair. 2005.
15. Leucht P, Fischer K, Muhr G, Mueller EJ. Epidemiology of traumatic spine fractures. *Injury* 2009;40(2):166-72.
16. Bárbara-Bataller E, Méndez-Suárez JL, Alemán-Sánchez C, Sánchez-Enríquez J, Sosa-Henríquez M. Change in the profile of traumatic spinal cord injury over 15 years in Spain. *Scand J Trauma Resusc Emerg Med* 2018;26(1):1-8.
17. akharian E, Tabesh H, Masoud SA. [An epidemiologic study on spinal injuries in Kashan.] *J Guilan University Med Sci* 2004 Apr 10;13(49):80-5. Persian
18. Krbec M, Stulik J. Treatment of thoracolumbar spinal fractures using internal fixators (evaluation of 120 cases). *Acta Chir Orthop Traumatol Cech* 2001;68(2):77-84.
19. Hefny AF, Abbas AK, Abu-Zidan FM. Geriatric fall-related injuries. *Afr Health Sci* 2016;16(2):554-9.
20. Safaei MO, Dehnadi Moghadam A, Kamali GH. [Spinal fractures in admitted patients in Poursina Hospital.] *J Guilan University Med Sci* 2008 Jul 10;17(66):38-43. Persian